NEW APPROACHES TO THE BIO-MINERALIZATION PROCESSES OF CALCIFIED SKELETONS IN CORALLINE DEMOSPONGES. *Memoirs of the Queensland Museum 44: 492 1999*:- Biomineralization of calcareous basal skeletons in coralline sponges is a strongly phylogenetically convergent character (Reitner, 1992). However, the basic mineralization process is ancestral and exhibits similarities with mineralization processes known in bacterial biofilms and organo-mineralization via controlled taphonomy (Reitner et al, 1997). The main biocalcification events in the phylogenetically distinct taxa *Vaceletia* sp., *Astrosclera willeyana*, *Ceratoporella nicholsoni*, and *Spirastrella (Acanthochaetetes) wellsi* are discussed. *Vaceletia*, a demosponge with a thalamid basal skeleton, exhibits the most ancestral mode to build a calcareous skeleton via controlled taphonomy. The stromatoporoid *Astrosclera willeyana* intracellularly forms egg-shaped aragonitic asters in a first step which grow together via an epitactical process. The chaetetid *S. (Acanthochaetetes) wellsi*, phylogenetically the most evolved coralline sponge taxon, forms its unique high-Mg calcitic skeleton in extracellular acidic organic mucilages in the presence of collagen. In all cases the mineralization is controlled by acidic matrix proteins. All aragonitic basal skeletons are characterized by high amounts of Sr and U. In *Ceratoporella nicholsoni* an increase of Mg, Sr and U in the old skeletal parts is observed using ICP-MS based geochemical analyses. The decrease of P concentrations is probably linked to the collapse of the intracrystalline matrix proteins. In *Ceratoporella* two distinct Ca^{2+} - binding matrix proteins are observed which are enriched in the amino acids asp (20 mol%) and glu (15 mol%) (18kd, >100kd). The uppermost growing zones exhibit relatively light $\delta^{13}C$ 3.8 and $\delta^{18}O$ -0.4 values on average.

Astrosclera differs in many aspects from the phylogenetically closely related *Ceratoporella*. The newly formed aragonite asters are depleted in ^{13}C ($\delta^{13}C$ 3.5) in comparison with the mature basal skeleton. The spherulites are enriched in Sr, P, Li and Mo. In the youngest cementing area of the spherulites the content of ^{13}C increases to $\delta^{13}C$ 4.03. *Astrosclera* exhibits five acidic matrix proteins, the smaller ones (17kd, 30kd) controlling the spherulite growth, and a large one (120kd) which probably controlls the cementation process.

The young portion of the basal skeleton of *Vaceletia* n.sp. differs from the aragonitic basal skeletons of the other coralline sponges. Mg and P is extremly enriched and the carbon isotope composition is relatively light ($\delta^{13}C$ 3.8). *Vaceletia* exhibits 10 acidic matrix proteins.

Acanthochaetetes has the most evolved basal skeleton which exhibit five acidic matrix protein. The small ones (ca. 20kd) control the initial calcification. The basal skeleton is a Mg rich calcite (19-20mol% $MgCO_3$). The uppermost growing zones exhibit light $\delta^{13}C$ values (2.65). The simultaneously growing inner cements have $\delta^{13}C$ 3.03. Based on the measured geochemical and isotopic data a vital effect during the early formation of the basal skeletons is very probable. The old or mature basal skeleton portions exhibit in all cases signals of a mineralization in equilibrium with the ambient sea water. ☐ *Porifera, coralline sponges, Vaceletia, reef-building sphinctozoans, Acanthochaetetes.*

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